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Rainbow Trout Culture in South Dakota

by Marley Beem, Extension Aquaculture Specialist

On a lettuce leaf with a twist of lemon, you can't tell a "wild" trout from a good commercial fish farm rainbow. Demand for trout far exceeds supply, and most South Dakotans will settle gratefully for a commercially raised rainbow. There are customers out there if you are thinking of adding a commercial trout enterprise to your farming or ranching operation.

This Extra provides information about raising trout in existing ponds and lakes in South Dakota. Trout culture in many areas of the state is new, therefore research from other states is the basis for much of the information in this Extra.

The most important advice is to start small and grow. You will learn the pitfalls with little financial risk and develop local markets for your fish at the same time.

Rainbows have two major requirements for growth and survival: 1) proper water temperatures and 2) adequate levels of dissolved oxygen. Clear water is not required, although it is usually a good indicator of excellent water quality.

Pond suitability

The ideal site for trout culture is a pond a couple of acres in size with an average depth of 20 or more feet of clear water with little or no algae or aquatic plants.

These deeper ponds will warm slowly, allowing a longer growing period before dangerously high temperatures are reached. Ponds with plenty of inflowing spring water can be smaller and still hold temperatures down.

Trout culture is also possible in smaller and shallower waters, but the danger of high temperatures increases. For good growth, water temperatures should be between 55 and 68 F and oxygen levels should be high (6.0 mg/l or more). Water temperature and oxygen level will be lower at greater depths.

Dugouts smaller than a half acre in size and less than an average 9 ft in depth in late summer are likely to warm up too quickly to grow trout. Ponds receiving large amounts of nutrients either from runoff or from large numbers of cattle are likely to have low oxygen problems.

If more than a fourth of the pond is covered by aquatic weeds, oxygen problems are likely. Some access by cattle can be beneficial, because the sediments stirred up can discourage weed growth by shading. However, too many cattle should be avoided.

The only way to be certain that a pond is suitable for trout is to measure temperature and oxygen levels throughout the course of the growing season or to grow a limited number of trout as a test.

Loose stocking vs cage culture

Trout may be cultured either loose in ponds or in specially designed cages. The method you choose depends on the characteristics of the pond and the labor available for harvesting the fish.

In a pond large enough to hold temperatures below 70 F during the summer at depths where oxygen remains above 6.0 mg/l, loose stocking will allow you to use a smaller, less expensive fingerling. Natural food in the pond may also reduce the need for purchased feed.

Loose stocking is not recommended in ponds unable to maintain low temperatures in the summer or in ponds with a heavy growth of algae. Do not stock trout loose into ponds containing bass, walleye, or other predatory fishes.

Gill netting is the best means of harvesting loose fish where standing timber or an irregular bottom makes seining impossible. Fish harvested by gill net cannot be restocked and expected to survive. A permit from the Game, Fish and Parks Department is required to possess or use a gill net.

In most situations, cages will be preferred, since they allow 100% harvest of fish with minimal labor.

Cages that are 8 ft deep can extend the growing season by allowing trout to stay in water that is several degrees cooler than surface water. Shallow cages (4 ft deep) are easier to handle and cheaper, but may not allow the fish to drop to cooler water unless the pond holds its temperature due to natural springs or lots of shade.

Start with 8-ft cages. If the extra depth proves unnecessary, you can split them into 4-ft cages later.

Buy or build cages. Either way, they are cheap compared to the cost of fingerlings and feed, so use many smaller cages instead of a few large ones. This will make handling easier, allow better flow of water through the cage, and minimize your loss if a disease problem develops in one cage. See Extension Extra 12002 for instructions on cage construction.

The growing season

The best growing season for rainbow trout in most South Dakota ponds is from approximately 2 weeks after ice breakup in April until water temperatures rise to 70 F in mid summer. The exact time of harvest will vary from pond to pond and year to year. Water temperatures are the key.

Trout can also be grown in the fall, but the risk of high temperatures or low oxygen levels do not make this advisable. Stock only after water temperatures remain below 70 F and harvest prior to freeze-up in November. The chance of low oxygen levels is greater in the late summer, due to warm temperatures and algae growth.

If necessary, trout can be held over winter, but this is not advised. At low temperatures, trout slow or stop growing but still need feed, and ice cover makes feeding difficult.

Unless the pond is 20 or more feet deep, there is also a large risk of fish kill due to lack of oxygen.

Getting started

Anyone raising food fish for sale in South Dakota must obtain a fish hatchery license from the Department of Game, Fish and Parks, 445 East Capitol, Pierre, SD 57501-3185. In addition, it is advisable to discuss your plans with the local conservation officer and keep all bills of sale so that you can prove the source of your fish. When selling fish, retain a copy of the bill of sale in case your customer is questioned about having more fish than allowed by the possession limit.

If your pond is suitable, the next step is to purchase fingerlings. Your Extension agent can give you the names of the closest suppliers.

Given the short period of suitable water temperatures in most ponds, start with fish which are a minimum of 6 inches in length. Smaller fingerlings will only be able to reach a marketable size (10-12 inches) if they are stocked in spring-fed ponds where temperatures never exceed 70 F.

If you order a large number of fingerlings, the producer may deliver for an additional charge. Otherwise, ask for advice on how to deliver smaller quantities.

Buy only top quality fingerlings. Fish should not be skinny or have any signs of disease such as redness around the mouth, white spots, sores, strange swimming patterns, sunken or swollen eyes, or swollen abdomen. In addition, trout which are imported from other states must be accompanied by a disease free import certificate.

Adequate oxygen must be provided during transport. Use a 12-volt aerator which runs off your battery or a welding oxygen cylinder and regulator together with a large airstone diffuser, or both.

If you choose an aerator, be sure you have a strong battery and leave your motor running if you stop.

After arriving at your pond, use a thermometer to check the water temperature in the hauling tank and in the pond. If they differ by more than a few degrees, you will need to "temper" the fish by adding pond water over a period of 30 to 60 minutes.

In most cases, a long handled dip net with a soft mesh is the best way to move the fish from vehicle to pond. If fish are not handled roughly, they will be healthy and taking feed in a few days, provided the water temperatures are acceptable.

Feeds and feeding

Trout demand high quality feed. Special order from your feed dealer if necessary. It must be a floating type trout feed containing at least 36% crude protein.

Floating feed allows you to easily see how well your fish are feeding and is the only type of feed that can be held in cages long enough to be consumed. Pellet size should be 1/4 inch in diameter (Purina developer size) for a 6-inch fish. Smaller fish require a smaller size. As the fish grow, a larger pellet may be used, but this is not necessary.

It will take about 1.7 lb of feed to produce 1 lb of trout. For the standard sized cage stocked with 300 trout, approximately 300 lb of feed will be needed.

Fish should be fed at least once daily. Feed at the same time and in the same way each day. Initially, feed will not be readily taken, but after a few days the trout will be noisily splashing about soon after the feed hits the water.

Start off by feeding about 1% of total fish body weight per day, and increase this to 3% body weight daily after they begin actively feeding. Use Table 1 and a small can or jar to measure the amount you use, and keep records.

An easier way is to observe how the fish are feeding.

Give them all they will eat within a 10-minute period. When feed is not being cleaned up, reduce the rate.

Reset your feeding rate once each week. To get the most growth for your feed, split the daily ration into two parts and feed twice daily.

An alternative to hand feeding is an automatic or a demand feeder. Automatic feeders dispense feed as often as you like in the amounts you set. Their major drawback is their price (about $300). Demand feeders allow the fish to feed by themselves by bumping into a trigger plate, in effect setting their own feeding rate.

Windy locations may not be suitable for demand feeders.

Diagrams showing simple demand feeders that can be easily built are available through your Extension agent. Inexpensive demand feeders are also available from suppliers.

Regardless of the feeding method, it is important to observe your fish feeding. If they do not feed well, something is wrong. Inspect them closely for signs of disease.

Any disturbance of the fish can also put them off their feed. Keep them calm; don't pull up the cage to look at them.

Of course, feed consumption will naturally be less during periods of low or high water temperature.

Stocking rates

All ponds have an upper limit of fish holding capacity. Fish produce waste products that must be broken down by natural processes in the pond. Too many fish produce more waste than the pond can handle.

In general, do not produce more than 1000 lb of fish/surface acre unless there is a significant amount of water flowing through the pond year-round. If, for some reason, you must hold more than this amount of fish, reduce the feeding rates. Never feed more than 30 lb of feed/surface acre/day.

Overfeeding (and the resulting poor water quality) is the leading cause of fish kills for beginning fish farmers. Diseases often start because fish are stressed by the poor water quality. Ponds that have received too much feed may not be suitable for fish culture for years.

Ponds already receiving high levels of nutrients will normally have large amounts of algae, as shown by green or green-brown water. If you cannot see your hand after sticking your arm up to the elbow in the water, the pond is likely to have low oxygen.

The recommended cage, 3 ft in diameter and 8 ft deep, should be stocked with 300 fingerlings. If your cage is a different size, stock 10.6 fingerlings per cubic foot of the volume of the top 4 ft of the cage. This means that cages 8 ft deep should hold no more than the same cage if it were 4 ft deep.

Don't understock. There should not be less than 3.5 fish per cubic foot. They may become aggressive and begin fighting.

It seems like this is a lot of fish to pack into a small space, but water constantly moves through the cage and trout are tolerant of crowding.

Remember the pond limit of 1000 lb/surface acre at the end of the growing season.

If something is wrong

In spite of your best efforts, fish will sometimes go off feed or begin dying. Small numbers of dying fish are usually due to high water temperatures or a disease problem.

If a disease is suspected and fish are in cages, isolate them by moving their cage. For fish close to harvest size, the best answer is usually to process them. Trout diseases should not be harmful to man.

A disease diagnosis cannot be made without laboratory tests of live fish. The trouble and expense of shipping several samples may not be justified if only a few fish are involved. Trout disease diagnosis is available through the McNenney Trout Hatchery, 605-642-3484.

Do not attempt chemical treatment of diseases without the assistance of experienced people. Many chemicals are illegal to use on food fish, and it is easy to kill fish by overdosing.

A sudden large fish kill may be due to low oxygen levels or a pesticide that has accidentally entered the pond. Little can be done in these cases.

In ponds with very clear water, algae may clog the mesh of the cages. A horizontal floating "collar" made of black plastic may cut down on the amount of light entering the water and greatly slow or stop algal growth.

Production economics

Table 2 shows an enterprise budget for caged trout production under South Dakota conditions. Start-up costs are about $300/cage (300 fish/cage), assuming all feed is bought in advance.

One surface acre of pond could support a five-cage operation producing 940 lb of trout. This would require an investment of around $1500 and return a $400 profit. The cost of 138 hours of your labor is not included.

The rate of labor inputs and the cost of tranporting fingerlings to the pond will decrease as the scale of operation grows. The return per hour of operator labor increases sharply as the number of cages increases, but marketing more than 1000 - 2000 fish will be challenging for most people. Growing too many fish will result in decreased profits.

Marketing trout

Many people find that they want to grow trout only for themselves and their neighbors. This is a fine way to satisfy your hunger for trout and reduce your food costs.

The highest price you can get for your fish comes from selling to local customers at the pond bank. Selling several hundred pounds of trout to nearby people is usually not too difficult.

After a few years, most small producers should be able to sell as much as 1000 lb of fresh, unprocessed trout to local customers at the pond bank. Do not expect to sell that your first year unless you are a good salesman. Build your market slowly.

You may be able to sell trout through local food stores on a seasonal basis. Such arrangements should be made well in advance. There is not much time to sell the fish after they grow to harvest size and before water temperatures rise above the danger level. It will probably be uneconomical to freeze and hold trout for longer periods of time.

Competition with major trout producing states is unlikely to be successful, since they enjoy water that remains optimal for trout year-round.

If your pond is spring-fed and is close to a city or in a tourist area, you may be able to operate fee-fishing ponds.

Fishermen are usually charged first to get in and then per pound of fish caught. Cleaning fish, refreshments, and fishing equipment rentals often make up a large percentage of the profits.

On the other hand, someone must be present at all times, and liability insurance is recommended. A permit from the state is required to operate a fee-fishing pond.

Restaurants are another possible outlet, but they usually want items on a year-round basis. Smoked trout may be marketable through a variety of outlets.

Checklist of key points

1. Pond large enough and deep enough to maintain temperatures below 70 F during April, May, and June.

2. High-quality floating trout feed containing at least 36% crude protein in a pellet size of 1/4 inch for 6-inch fingerlings.

3. Cage constructed according to specifications or else adequate labor to harvest by other means.

4. Marketing outlets able to accept your total production of fish.

For further information, see your Extension agent or Extension Extras 12001, 12002, and 12004.

Table 1. Rainbow trout feeding guide.*

Size of Fish		Water Temperature					
Ounces	Inches	40	45	50	55	60	65
		Percent of Total Body Weight to Feed Daily					
2	6-7	1.2	1.4	1.6	2.0	2.5	3.0
3	7-8	1.1	1.3	1.6	1.9	2.4	2.8
4	8-9	1.0	1.2	1.5	1.8	2.1	2.3
7	9-10	0.9	1.1	1.4	1.7	1.9	2.1
10	10-11	0.8	1.0	1.2	1.6	1.8	2.0

* Adapted from "Nutrient Requirements of Coldwater Fish", 1981, National Academy Press

Table 2. Enterprise budget for production of trout in cages.

Production Expenses	
Rainbow Trout Fingerlings 6-inch, $0.40 each	$ 600.00
Transport of Fingerlings 200 miles @ $0.20/mi	40.00
Trout Feed* 1600 lb @ $0.40/lb	640.00
5 Cages (home-built) $70.00 each, 5 year life	70.00
Misc. Equip. & License	80.00
Interest Foregone 6% simple interest over 6 mo	42.90
TOTAL COST**	$1,472.90
Net Return if Sold @ $2.00/lb live weight	402.10
Cost per lb	1.57

* Feed Conversion Ratio = 1.7 lb feed/1.0 lb trout

** Cost of labor not included

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